

**University Funding Systems and their Impact
on Research and Teaching: A General Framework[§]**

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This version: April 2005

Abstract

This paper addresses the following question: how does a higher education funding system influence the trade-off that universities make between research and teaching? We do so by constructing a general model that allows universities to choose actively the quality of their teaching and research when faced with different funding systems. In particular, we derive the feasible sets that face universities under such systems and show how, as the parameters of the system are varied, the nature of the university system itself changes. The “culture” of the university system thus becomes endogenous. This makes the model useful for the analysis of reforms in funding and also for international comparisons.

Keywords: University funding system, higher education, teaching quality, research quality, research elite.

JEL Class. Nos.: I21, I22

[§] Acknowledgements: We would like to thank Robert Owen (Université de Nantes) and Yannis Katsoulacos (Athens University of Economics and Business) for helpful discussions and MAICH (Chania, Crete) for the hospitality provided while Beath and Ulph were working on the initial ideas leading to this paper. Beath and Poyago-Theotoky acknowledge the ESRC for financial support (grant no. RES-000-22-0340).

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NON-TECHNICAL SUMMARY

Is the UK university system heading back towards the binary divide that typified higher education before 1992? If so, will the divide be where it was then? Would this be a good thing? Just what determines the amount and quality of teaching and research that universities do and what impact does the system of public funding have on this? These are the kinds of questions this paper addresses.

Universities add to the stock of useful knowledge through their research and disseminate that stock through their teaching. Achieving quality in teaching and research takes time and as academics are time-limited, they face a stark choice. The more of their time that they spend on research, the higher is likely to be its quality. However this cuts back on the time that they can spend teaching students and, as this has implications for staff-student ratios, it will have a negative impact on teaching quality. Of course, in view of agencies such as the Quality Assurance Agency – as well as the increasing “voice” of the student consumers, there is going to be some quality threshold in teaching that all universities will need to attain. We take account of this in our analysis.

In publicly funded systems, financial resources come as grants for teaching and grants for research. While there is as yet no quality-related component to the grant for teaching, this is not true of research – at least in the UK since the advent of the periodic research assessment exercises.¹ We have therefore allowed there to be a teaching grant proportional to the number of students that a university has on its books and a research grant with a fixed amount per staff member and a quality-related component. There is a minimum quality threshold above which the quality component kicks in and we explore what happens as the scale of this quality factor is varied.

¹ Some other European countries, as well as Australia and New Zealand are now considering moving their HE funding mechanisms in this direction.

Every university has its own mission: some stress their contribution to teaching excellence and others their research excellence. Although every university would wish to excel in both, the competing demands of teaching and research on academics' time mean universities are faced with an inevitable trade-off between these: a tragic choice. Some will emphasise teaching over research, some research over teaching, and yet others will seek to have a balanced portfolio in which they deliver a solid performance in both.

So, what happens if the funding mechanism increasingly rewards research quality? This is an interesting question for two reasons. The first is that it allows us to compare university systems in general across countries; the second is that it allows us to examine what has happened (and may continue to happen) over time within any one country.

Start with a completely flat system in which universities are funded for teaching students and receive a block grant per academic to support research and scholarship. Our analysis predicts that, while there may be the odd university that focuses almost wholly on teaching and whose research quality is modest, the vast majority will be moderately good at both teaching and research, but there will be none doing world-class research. In such a system academics will be absorbers of ideas rather than their creators. If we then introduce a premium for research quality, this can only be funded, given the overall fiscal balance, by reduction in the block grant element. It may also require a university to achieve some threshold level of quality before the premium is paid. What results is a university system in which there is bifurcation: a small research elite will emerge while the bulk of institutions will be strong in teaching and solid, if uninspiring, in research. If we now further increase the steepness of the reward function for research quality, we will end up with the kind of system that we had in the UK prior to 1992. In other words, the binary divide will be restored and we will get one set of the higher education institutions concentrating on teaching and doing minimal research and the remainder doing high-quality internationally-rated research. Between these two groups a gap in the research

quality spectrum will open up in which there are no institutions present. Might this outcome be problematic from the point of view of society? Well, if this research of “national” quality were to be the kind of research that is extremely valuable for policy, we would have a problem. In one group of universities, academics are so busy teaching, they haven’t the time to think about policy and, in the other group, the academics are so busy trying to deliver research at the frontiers of knowledge, they have neither the time for nor the interest in it!

Our results are thus of considerable relevance to the current debate on just where higher education is going.

1. Introduction

Universities add to the stock of knowledge by research and disseminate that stock through teaching, but what determines the amounts of each that they do? We seek to answer that question in this paper and show how the culture of a university system will systematically depend on the way that the higher education sector is funded. We do this by constructing a model in which the budget constraint facing the sector plays a crucial role in determining the kind of research and teaching culture that will emerge. We use a generic type of funding model and, as we vary its parameters (specifically the premium for and the “marginal cost” of research quality, as well as the threshold level of teaching quality), we find that one can get the emergence of cultural phenomena such as “research elites” and the “binary divide”.

There is a substantial literature in the economics of higher education (Clotfelter (1999)). However, this has tended to focus on the costs of and returns to higher education, often concentrating on issues associated with various financing/funding systems and their effects on student participation as well as equity and welfare aspects (Barr and Crawford (1998), Chapman (1997), García-Peñalosa and Wälde (2000), Gary-Bobo and Trannoy (2004), Greenaway and Hayes (2003), Kaiser et. al. (1992), Kemnitz (2004)). There has also been a significant amount of work on the organisation of the university (e.g., Boroah (1994)), on the link between the quality of educational provision, mobility costs and student choice (de Fraja and Iossa (2002), del Rey (2001)) and on the allocation of academics’ time (Beath et al. (2003), Hare (2002)).

On the other hand, relatively little attention appears to have been paid to the question of the link between what universities actually do, in terms of both teaching and research quality, and the way in which they are funded. In view of the important role envisaged for universities in the “knowledge economy”, particularly where they are supported by public funding,² it seems surprising that the link

² European universities are heavily reliant on the public purse; e.g., Germany spends 1% of GDP on higher education yet only 0.1% is funded by the private sector (The Economist,

between the type of funding system and the mix of activities that universities undertake has not been explored in greater detail. An exception to this is a recent paper by Del Rey (2001). This paper analyses a stylised game between two universities that are competing for students in a Hotelling-like fashion and can spend their publicly provided budgets on teaching and research. The universities seek to maximise an objective function of the quality of their student output and their expenditure on research. Del Rey's paper characterises the sub-game perfect equilibria and explores how these vary as the parameters of the funding system are changed and in particular, the balance between research and teaching effort as a function of the funding rules. An unsatisfactory aspect of this paper is that research is treated as a residual item in the universities' budgets and no attention is paid to its quality. What we seek to do in the present paper is to incorporate research quality directly into a university's budget constraint and to provide a rather general modelling framework that allows universities to actively choose the quality of their teaching and research when faced with different funding systems. In particular, we derive feasible sets that face universities under different funding systems and show how, as the parameters of the funding system are varied, the nature of the university system changes. Thus we endogenise the 'culture' of the university system. We believe that in the current climate of the higher education sector, this is important if one is concerned with making comparisons with actual systems across different countries, especially in the UK and Europe.

The paper is organised as follows. Section 2 introduces our model and sets out the generic characteristics of a university funding system. Section 3 uses that framework to analyse how a typical university, operating under the funding limits described in Section 2 chooses teaching and research quality. Section 4 discusses the results of the analysis and Section 5 concludes.

2. The Model

We describe a higher education system in which there is a continuum of universities; without loss of generality we set its mass equal to one.³ The characteristics of the system are as follows:

[1] The *minimum* teaching quality is specified by the funding authority. Rather than specifying this directly, we capture this by the fraction of time, $\underline{t} < 1$, that academics have to spend on teaching in order to meet this minimum requirement.

[2] Universities are funded under the mechanism, $I = pS + AR(q)$,

where I is a university's income, p is the unit of resource delivered by the system for teaching a student⁴, S is the number of students⁵, A is the number of academics, $R(q)$ is the research funding per academic, and q is the quality of research produced by academics. Notice that we have chosen here not to relate funding to teaching quality.⁶

[3] The research funding function $R(q)$ takes the form:

$$R(q) = \alpha + \rho \max[0, q - \underline{q}]$$

where $\alpha \geq 0$ is the lump-sum payment per academic, $\rho \geq 0$ is the research quality premium, and $\underline{q} \geq 0$ is the research quality threshold. This is quite general so that $\alpha > 0, \rho = 0$ corresponds to a funding system without incentives while $\alpha \geq 0, \rho > 0$ corresponds to an incentivised system. A university funding system is then defined by the vector $(\underline{t}, p, \alpha, \rho, \underline{q})$. In the analysis that follows we shall treat \underline{t} and p as

³ In this paper we stay away from inter-university competition and related issues of imperfect competition in higher education. These are not without interest but our focus here is on how the choice of teaching and research quality is affected by various funding systems.

⁴ In the UK this would be the sum of the teaching resource provided by the funding council through its TR grant and the tuition fee that a student pays. In other systems, this could be entirely funded by the student fee.

⁵ Note that we treat the population of students as a homogeneous group, i.e., we do not distinguish undergraduates from postgraduates. However, in later work, it would be interesting to consider separately how these two groups of students respond to changes in the funding mechanism and also on the quality of teaching and research provided.

⁶ The reason is that our primary aim is to focus on the effects of incentivising universities to perform research, so it seems useful in the first instance to ignore teaching quality incentives. Moreover, while it may be possible to specify and measure minimum teaching quality (and we allow for that possibility), measuring actual teaching quality is far more controversial and resource intensive. We could also argue for this approach on grounds of realism.

exogenous and will examine how different values of the remaining parameters determine the choice a university makes with respect to the teaching and research quality it offers.

[4] Academics are identical in terms of teaching and research ability.⁷

[5] Academics deliver a teaching quality at or above the minimum; this takes a fraction $t \geq \underline{t}$ of their time. It follows then that the staff-student ratio, A/S , determines the amount of time academics have for research, and hence, through $R(q)$, the quality of research. We summarise this relationship through the following function

$$\frac{A}{S} = g(q, t), \quad \frac{\partial g}{\partial q} > 0, \quad \frac{\partial g}{\partial t} > 0. \quad (1)$$

To be more precise, suppose that each academic has one unit of time to spend on teaching or research, and, as above, that it costs t units of academic time per student to achieve the specified teaching quality, \underline{t} . Thus, if a university has A academics and S students with $A \geq tS$ then the amount of time each academic can devote on research while achieving minimum teaching quality is

$$r = 1 - t(S/A).$$

The quality of research, q , is related to the time devoted to research, r , via the simple function $q = r^\gamma$, $0 < \gamma < 1$, indicating diminishing returns to time spent on research.

Then $1 - t(S/A) = q^\beta$, where $\beta = (1/\gamma) > 1$. As a result, equation (1) becomes

$$g(q, t) = \frac{t}{1 - q^\beta}, \quad 0 \leq q \leq 1. \quad (1')$$

[6] Academics are paid a fixed salary, $w > 0$. The fact that w is independent of q is made to enable universities to enforce a target level of quality on teaching.

[7] There are no other sources of income for universities, and the salary bill for academics is the only cost. Consequently a university faces a budget constraint

$$wA \leq pS + A(\alpha + \rho \max[0, q - \underline{q}]) \quad (2)$$

Notice that using the relationship in expression (1) we can re-write this as:

$$wSg(q, t) \leq pS + Sg(q, t)(\alpha + \rho \max[0, q - \underline{q}]),$$

or,

$$w - \frac{p}{g(q,t)} \leq \alpha + \rho \max[0, q - \underline{q}] \quad (3)$$

For the particular form given in (1') above this becomes:

$$\left(w - \frac{p}{t} \right) + q^\beta \frac{p}{t} \leq \alpha + \rho \max[0, q - \underline{q}]. \quad (3')$$

[8] Finally we assume that all universities have as their mission the creation (research) and dissemination (teaching) of fundamental knowledge. Thus universities care about two issues: the quality-weighted volume of research they produce, qA , and the quality-weighted number of graduates, $\tau(t)S$, where $\tau(t)$ is a function that determines the quality of teaching when a fraction t of academic time is devoted to it. Thus each university's objective function can take the general form $U[qA, \tau(t)S]$, where U is strictly increasing in both arguments. We allow the possibility that universities may differ in their views as to the relative importance of teaching and research and so may have different objective functions within this class. Notice that, by substituting (1) we can write this as

$$V(q, t, S) = U[qg(q, t)S, \tau(t)S]$$

which, for given, S , is a strictly increasing function of t and q . Indeed, in the special case where $U(\cdot)$ is homothetic, this can be written:

$$V(q, t, S) = \eta(t, q)\sigma(S).$$

In the sequel we will use this particular functional form, and, moreover, restrict our attention to the case where

$$\eta(t, q) = \omega q + (1 - \omega)t$$

⁷ This assumption is made to simplify the analysis. Moral hazard and/or adverse selection issues are outside the scope of the present paper but not without interest.

where ω , $0 \leq \omega \leq 1$ is the relative weight that a university places on research. Note that ω is the characteristic that differentiates universities; it is distributed in the university population according to the distribution function $F(\omega)$, $F(0) = 0, F(1) = 1$, with density $f(\omega) = F'(\omega)$.

3. Analysis

We now examine what options are open to a university that is constrained by the budget constraint as defined by (3'). To do this, suppose for the moment that a university is delivering the minimum teaching quality, and consider what research quality it can achieve. Then (3') becomes

$$\left(w - \frac{p}{\underline{t}}\right) + \frac{p}{\underline{t}} q^\beta \leq \alpha + \rho \max[0, q - \underline{q}], \quad (4)$$

and represents the funding constraint faced by a university when it offers the minimum teaching quality, i.e. $t = \underline{t}$. Notice that the LHS of (4) is a strictly increasing and strictly convex function of research quality, q , that takes the value $w - \frac{p}{\underline{t}}$ when $q = 0$ and the value w when $q = 1$. It also has a simple interpretation: it is the resource per academic that is needed to deliver research of quality q when the quality of teaching is at its minimum threshold level. The RHS of (4) is a piecewise linear function that takes the value α when $0 \leq q \leq \underline{q} \leq 1$ and the value $\alpha + \rho(1 - \underline{q})$ when $q = 1$. It also has a simple interpretation: the resource per academic that is actually delivered by the funding system for research of quality q . Clearly, if research of any given quality is to be achieved, the resources must be at least sufficient to meet the needs. In fact we will make two further assumptions:

Assumption 1. *The university funding system is such that there exist some $q \in [0, 1]$*

$$\text{such that } \left(w - \frac{p}{\underline{t}}\right) + \frac{p}{\underline{t}} q^\beta > \alpha + \rho \max[0, q - \underline{q}]. \quad (\text{A1})$$

Assumption 2. *The university funding system is such that there exist some $q \in [0, 1]$*

$$\text{such that (4) is satisfied.} \quad (\text{A2})$$

If (A1) were not satisfied then the range of values of q that satisfy (4) is the entire interval $[0,1]$, and so universities would face no effective restriction on the quality of research they can achieve. In other words by invoking (A1) we are ruling out the possibility that universities are so generously funded that they face no constraints on research quality! One immediate implication of (A1) is that $\alpha < w$. This is inherently plausible – university funding systems do not provide universities a minimum amount of funding per academic for research that exceeds the average academic salary. If (A2) were not true then effectively universities are so badly funded that no university could deliver even the lowest quality research while meeting the minimum teaching quality threshold.

An implication of assumptions (A1) and (A2) is that we need to partition the analysis into two sets of cases. Set A is the set of cases where $w - \frac{p}{\underline{t}} < \alpha < w$, while set B is the set of cases where $\alpha < w - \frac{p}{\underline{t}}$.⁸ The interpretation of these two conditions is as follows: $1/\underline{t}$ is the number of students an academic can teach while achieving minimum quality, so p/\underline{t} is the amount of money the university receives per academic for teaching at minimum quality. So cases belonging to set A arise when the money for teaching is more than sufficient to cover the gap between academic salaries and the minimum payment per academic for research ($p/\underline{t} > w - \alpha$), while set B arises when that is not the case. We next turn to a detailed characterisation of these cases; this is then followed by a discussion of their implications.

Set A Cases: $w - p/\underline{t} < \alpha < w$

Define \hat{q} as the research quality such that teaching quality is at the minimum threshold and the budget constraint is binding in the absence of research incentives, that is,

⁸ The set of cases where $\alpha = w - (p/\underline{t})$ can be ignored since this set is of measure zero.

$$\hat{q} \equiv \left\{ q \left| \left(w - \frac{p}{t} \right) + \frac{p}{t} q^\beta = \alpha \right. \right\}.$$

Notice that given the definition for set A cases, there is a unique \hat{q} , $0 < \hat{q} < 1$ that satisfies the above equation. There are then 3 cases to consider.

Case A1. $\underline{q} \leq \hat{q}$

Assumption (A1) can only be satisfied if $\alpha + \rho(1 - \underline{q}) < w$, in which case the set of values of q that satisfy the budget constraint, see (4), is $[0, \bar{q}_1]$ where \bar{q}_1 is the unique solution to

$$\left(w - \frac{p}{t} \right) + \frac{p}{t} q^\beta = \alpha + \rho(q - \underline{q}). \quad (5)$$

This is illustrated in Figure 1.

[Insert figure 1 here]

To understand the next two cases let ρ^0 and $q^0 \geq \underline{q}$ be the unique solutions to the equation (5) above and

$$\beta \frac{p}{t} (q^0)^{\beta-1} = \rho^0, \quad (6)$$

where (6) is just the slope of the LHS of (4) evaluated at q^0 and set equal to ρ^0 .

Figures 2 and 3 illustrate.

[Insert Figures 2 and 3 here]

Case A2. $\underline{q} > \hat{q}$ and $\rho < \rho^0$

The only set of values of q that satisfy equation (4) is $[0, \hat{q}]$.

Case A3. $\underline{q} > \hat{q}$ and $\rho > \rho^0$

In this case equation (5) has two solutions: \bar{q}_2, \bar{q}_3 , with $\underline{q} < \bar{q}_2 < \bar{q}_3$.⁹ This subdivides further into two sub-cases:

⁹ The case where $\underline{q} > \hat{q}$ and $\rho = \rho^0$ is of no significance since this arises on a set of measure zero.

Case A3(a). In addition to the two conditions above suppose that $\alpha + \rho(1 - \underline{q}) < w$. Then $\bar{q}_3 < 1$. Thus the set of values of q that satisfy (4) comprises the union of two disjoint intervals $[0, \hat{q}] \cup [\bar{q}_2, \bar{q}_3]$.

Case A3(b). If $\alpha + \rho(1 - \underline{q}) \geq w$ then $\bar{q}_3 \geq 1$. Therefore, the set of values of q that satisfy (4) comprises the union of the disjoint intervals: $[0, \hat{q}] \cup [\bar{q}_2, 1]$.

Set B Cases: $\alpha < w - (p/t)$

It turns out that there is just one general case, though, as in case A3 above, this divides into two sub-cases. We can once again define ρ^0 and q^0 as the solutions to equations (5) and (6). In order to ensure that assumption (A2) is satisfied we need to impose that $\rho > \rho^0$. It is still true that equation (5) has two solutions: \bar{q}_2, \bar{q}_3 , with $\underline{q} < \bar{q}_2 < \bar{q}_3$. So there are just two sub-cases:

Case B(a) Here $\bar{q}_3 < 1$. This arises when $\rho^0 < \rho < \frac{w - \alpha}{1 - \underline{q}}$. Then the set of values of q that satisfy (4) comprises the interval $[\bar{q}_2, \bar{q}_3]$. Figure 4 illustrates this case.

[Insert Figure 4 here]

Case B(b) Here $\bar{q}_3 \geq 1$. This arises when $\rho \geq \frac{w - \alpha}{1 - \underline{q}} > \rho^0$. Then the set of values of q that satisfy (4) comprises the interval $[\bar{q}_2, 1]$.

4. Discussion: The Trade-off between Teaching and Research

To understand the full implications of the conditions that characterise each case described above, consider what happens when (4), the budget constraint, holds as a strict inequality – this happens when the research quality q offered by a university lies in the interior of the above quality intervals; in other words, there is a potential surplus of funding. There are two possibilities:

- (i) A university is achieving a given quality q of research, is teaching at minimum quality, but is accumulating a surplus that it is using to build up resources.

(ii) A university is achieving a given quality q of research but could be teaching at above minimum quality, so as to just break even. In fact we can define $\bar{t}(q) \geq \underline{t}$ as the maximum teaching quality achievable by a university when its research quality is q and it is just breaking even. This is given by

$$\bar{t}(q) \equiv \frac{p(1-q^\beta)}{w - \{\alpha + \rho \max[0, q - \underline{q}]\}}, \quad (\text{EF})$$

and describes an efficiency frontier (EF) in (t, q) space that can be plotted for each of the cases we have identified and characterised above. Next, we graph this frontier and discuss its implications. In the discussion that follows we assume that universities can freely choose where to locate on the frontier.

[Insert Figure 5 here]

Case A1. The efficiency frontier that this case produces is shown in Figure 5. This case is interesting because there is a unique value of ω , ω^0 , say, such that a university (with this specific characteristic) maximising its objective¹⁰ will produce a double tangency at, say \underline{q}^0 and \bar{q}^0 , where \underline{q}^0 lies on first hump of (EF) – and so $\bar{q}^0 < \underline{q}$ – and \bar{q}^0 lies on second hump – and so $\bar{q}^0 > \underline{q}$. No university will ever operate with q between \underline{q}^0 and \bar{q}^0 . Those universities with lower weight to research than ω^0 will choose $q < \underline{q}^0$, while those with higher weight to research than ω^0 will choose $q > \bar{q}^0$. So this case produces two discretely different groups of university – one group below the funding threshold, \underline{q} , and one above it (the ‘research elite’). There will be no universities close to the threshold. The explanation for the existence/sorting of the two groups lies entirely in differences in preferences over ω as captured by the distribution $F(\omega)$.

[Insert figure 6 here]

Case A2. The efficiency frontier that this case produces is shown in Figure 6. This case is also interesting because this is precisely the frontier that is produced if

there are no research incentives ($\rho = 0$). If this is the case, universities would be expected to spread themselves across the frontier (EF). The only reason for bunching would be if preferences were bunched – say there were a kind of binary divide with some institutions ordered to give a high weight to teaching and the others to research.

[Insert figure 7 here]

Case A3 The efficiency frontier that this produces is shown in Figure 7. This is drawn for sub-case 3a. To see the implications of this, consider the convex hull of the efficiency frontier. There are two cases. The first case is where the teaching quality when $q = 0$ is higher than the maximum on the right hand portion of the frontier. In this case the convex hull will consist of most of the downward sloping part of right hand portion plus a little bit of the left hand portion. Essentially the convex hull is exactly as in case A1. Once again two discrete groups of universities will form: those that do no research at all and those that do, i.e. a sort of binary divide across institutions.

The second case (not shown) is where the teaching quality at $q = 0$ is no higher than the maximum on the right hand portion of the frontier. Here the convex hull is just all of the downward sloping part of the right-hand side of the frontier plus a horizontal line at the maximum. Now all universities would be spread around the right hand of the frontier, and there would be no discretely different groups.

[Insert figure 8 here]

Case B The relevant efficiency frontier is shown in Figure 8. Here all the universities would be spread around the downward-sloping part of the frontier, and there would be no discretely different groups. This case is not very realistic since all universities obtain research funding and we shall not pursue it any further.

So, in summary, case A2 describes a non-incentivised system, and cases A1 and A3 describe incentivised systems that generate multiple equilibria in the sense of two discretely different types of university. In all three cases the funds available for

¹⁰ Given homothetic utility functions of the form we have assumed, indifference curves are straight lines with slope $-\omega/(1-\omega)$.

teaching per academic (p/\underline{t}) are more than sufficient to cover the difference between salary, w , and block grant, α , received. The non-incentivised system arises in equilibrium when the research funding scheme is relatively weak ($\rho < \rho^0$) and the research quality threshold is above the research quality associated with the minimum teaching quality and a binding budget constraint were incentives absent ($\underline{q} > \hat{q}$). The incentivised systems obtain (i) when the research funding scheme is relatively strong ($\rho > \rho^0$) and $\underline{q} > \hat{q}$ or (ii) for any research funding scheme when the research quality threshold is below the research quality associated with the minimum teaching quality and a binding budget constraint were incentives absent ($\underline{q} < \hat{q}$). Hence, the design and characteristics of the university funding system are determining in the manner that we have described a ‘culture’: an incentivised system gives rise to a ‘research elite’ co-existing with universities performing no (or minimal) research but all universities are providing at least the minimum teaching quality; a non-incentivised system by its nature leads to less polarisation.¹¹

5. Concluding Remarks

In this paper we have taken some first steps in modelling the way in which higher education funding systems can generate university “cultures”. The important elements in our modelling framework are as follows: (1) we have recognised that universities are principally concerned about the quality of teaching and research; (2) we have endogenised the choice by a university of its actual selection of teaching and research quality; (3) we have taken explicit account of the fact that research and teaching has to be performed by academics who face a time constraint; and (4) we have explicitly modelled the quality of teaching and research. Understanding how these interact matters if we are to be able to assess the implications of making higher education funding systems depend on indicators of teaching and research quality.

¹¹ We note here that one somehow unsatisfactory aspect with both systems is that no university is very close to the critical funding threshold. Essentially, what drives the outcomes is the diversity of views within universities as to their objectives as captured by the weight placed on research/teaching.

What we have shown is that, by varying the key parameters of the public funding system, a range of university “cultures” can be generated and this seems to offer a theoretical framework for empirical cross-country comparisons and for policy advice.

The model and analysis we have provided are quite general. Within this framework, there are a number of issues that can be examined, notably the evolution of university funding systems and the associated outcomes in the face of tightening public finances. This is part of our current research agenda.

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Appendix: Figures

Figure 1:

Case A1 : $\underline{q} \leq \hat{q}$

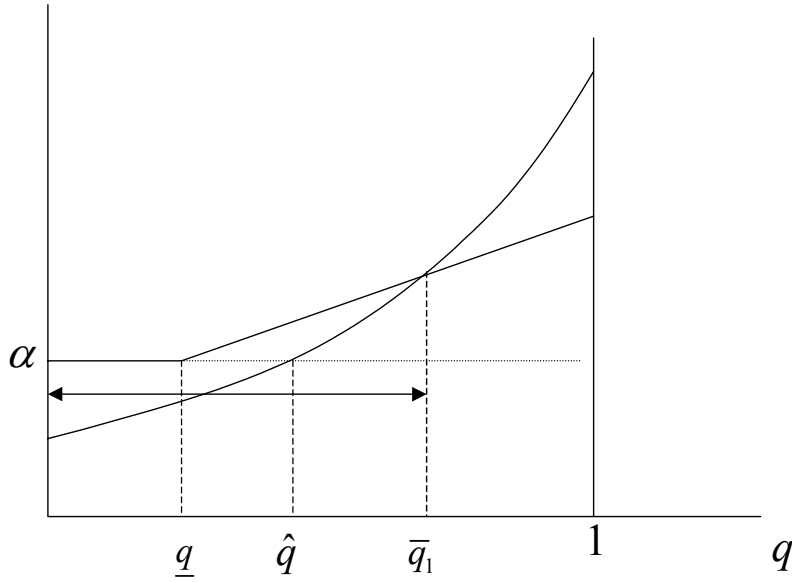


Figure 2

Case A2: $\underline{q} \geq \hat{q}$ and $\rho < \rho^0$

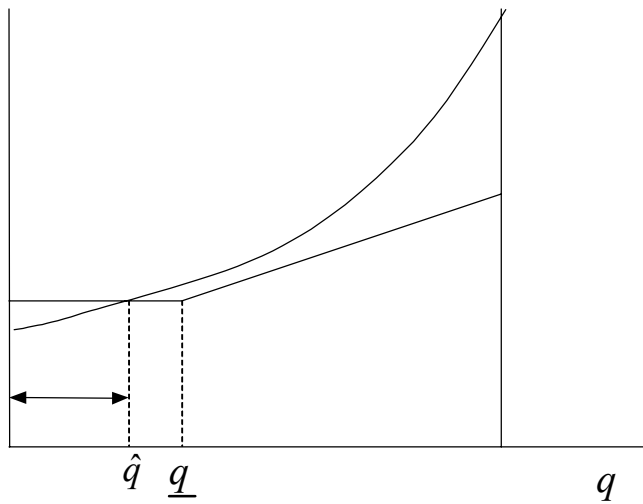


Figure 3

Case A3: $\underline{q} \geq \hat{q}$ and $\rho > \rho^0$

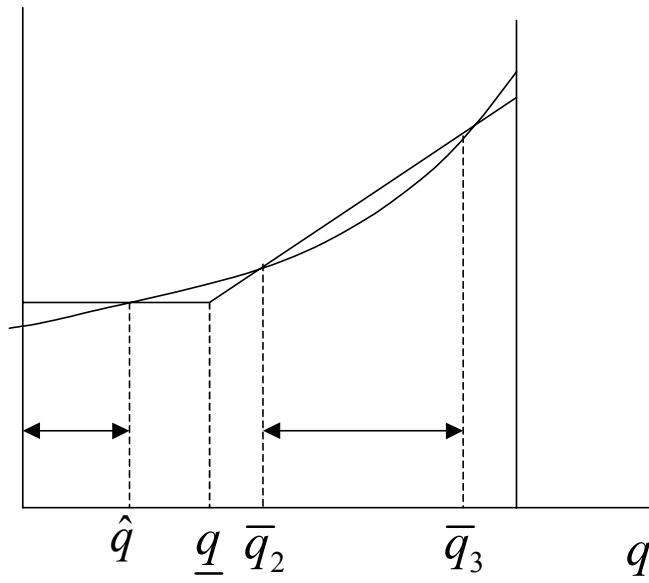


Figure 4

Case B

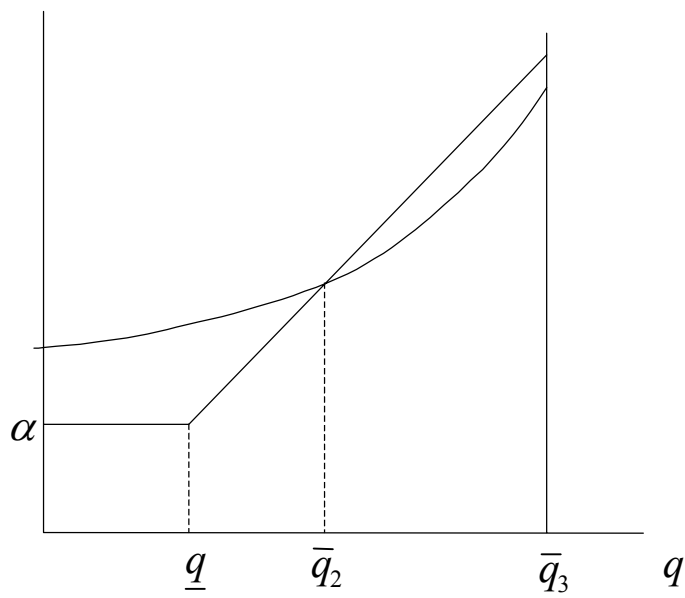


Figure 5

Case A1: The Research Elite

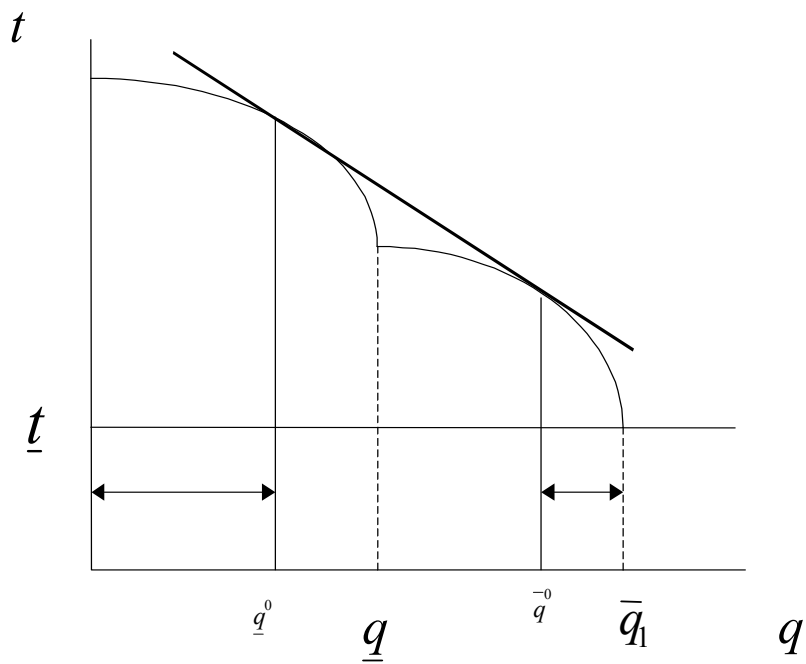


Figure 6

Case A2: No Research Incentives

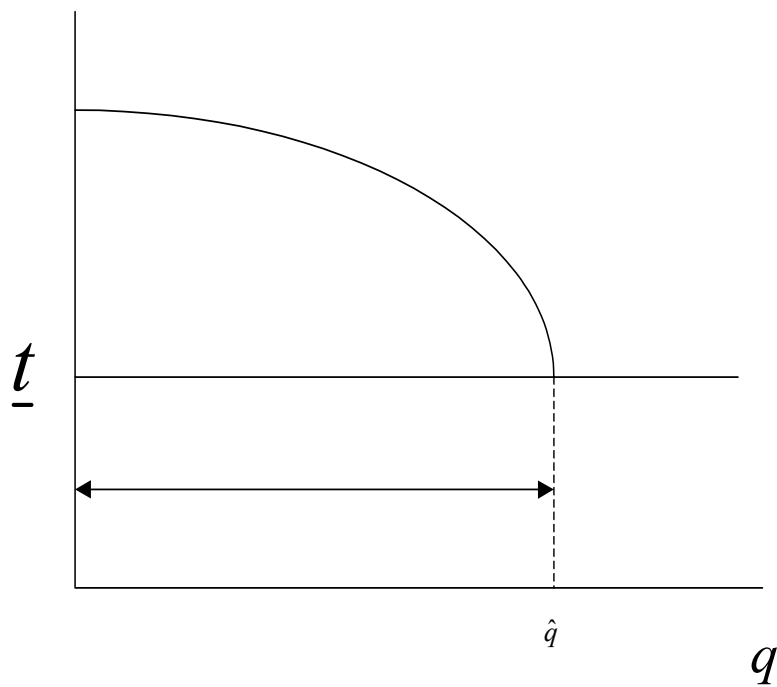


Figure 7

Case A3: An incentivised system (binary divide)

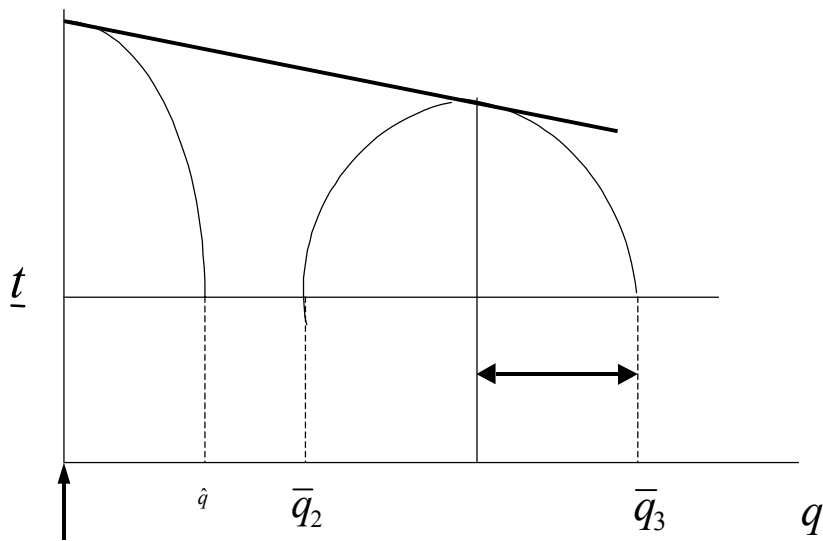


Figure 8

Case B

